

SRMs for Contaminants on Air Particulate Matter Less Than 2.5 μm ($\text{PM}_{2.5}$)

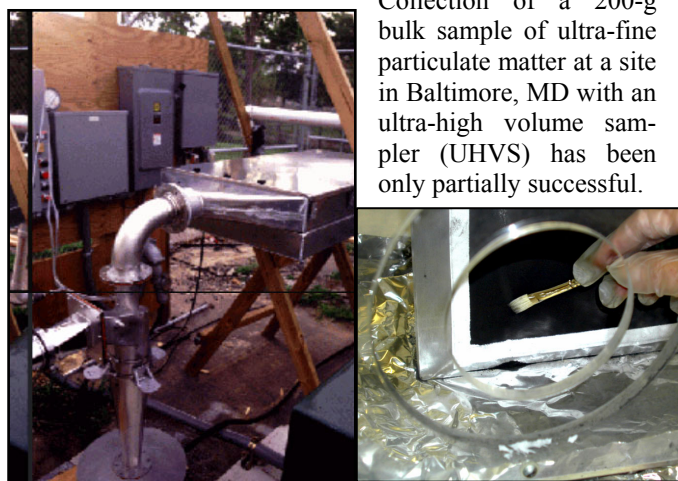
In 1997 the Environmental Protection Agency (EPA) issued new standards for air particulate matter (PM) under the national ambient air quality standards including new regulations for PM less than 2.5 μm ($\text{PM}_{2.5}$), which is the respirable PM fraction, in addition to the existing PM_{10} standards. Research recommendations have been made by the National Research Council at the request of Congress and EPA to focus on evaluating what types of particles cause detrimental health effects. To support compositional analyses and other investigations on the fine PM, quality assurance materials are necessary; however, few appropriate fine particulate materials are currently available to support this research. NIST has been collaborating with the EPA to develop SRMs to support measurements of organic species in fine PM.

M.M. Schantz, J.R. Kucklick, B.J. Porter, D.L. Poster, R.O. Spatz, S.A. Wise, R. Zeisler (Div. 839)

The NIST/EPA collaboration has focused on three projects: (1) establishment of an interlaboratory comparison program to assess measurement comparability, (2) development of solution SRMs for compounds of interest for PM measurements, and (3) collection of bulk $\text{PM}_{2.5}$ for use as a future SRM. Three interlaboratory comparison exercises have been conducted for the determination of organic contaminants and source markers in PM samples. A series of calibration solution SRMs are in progress for aliphatic hydrocarbons, polycyclic aromatic hydrocarbons (PAHs), nitro-substituted PAHs, hopanes/steranes, ^{13}C -labeled and deuterium-labeled levoglucosan, and acids (deuterium-labeled and non-deuterium-labeled).

As part of this collaboration, the Organic Speciation Working Group was formed in 2000 to assist in this effort by participating in interlaboratory comparison studies and by providing input for the development of SRMs to support these measurements. This group has participated in three interlaboratory comparison studies for the determination of PAHs, nitrated PAHs, alkanes (including hopanes and cholestanes), sterols, carbonyl compounds (ketones and aldehydes), acids (alkanoic and resin), phenols, and sugars in PM-related samples. Based in part on the results of these studies and input from the Organic Speciation Working Group, priorities for the development of a number of calibration solution SRMs were identified including: aliphatic hydrocarbons, PAHs, nitro-substituted PAHs, hopanes/steranes, ^{13}C -labeled and deuterium-labeled levoglucosan (for use as internal standards), and acids (deuterium-

labeled for use internal standards and non-deuterium-labeled). SRM 1494 Aliphatic Hydrocarbons in Iso-Octane was issued in early 2004. SRM 2260a PAHs in Toluene and 1491a Methyl-Substituted PAHs in Toluene, which are redesigned solutions with values assigned for an expanded list of 53 PAHs and alkyl-substituted PAHs, were issued in 2005. The remaining solution SRMs are in progress and will be completed in 2006.



Collection of a 200-g bulk sample of ultra-fine particulate matter at a site in Baltimore, MD with an ultra-high volume sampler (UHVS) has been only partially successful.

The Figure shows the air particulate sampler (left) used to collect $\text{PM}_{2.5}$ on filters (right) from which the PM is then brushed off.

Two collections of 20 g each have been used to prepare an interim reference material and for distribution in the NIST/EPA interlaboratory comparison exercises for the determination of organic compounds. The results from the second interlaboratory study using the interim reference material have been used in conjunction with NIST measurements to assign concentration values for the compounds of interest. This interim reference material was also characterized for inorganic constituents and is now available to laboratories involved in EPA $\text{PM}_{2.5}$ research programs for use as a control or reference material. The second $\text{PM}_{2.5}$ material collected in Baltimore was used in the third NIST/EPA intercomparison study along with SRM 1648 Urban Particulate Matter and RM 8785 Air Particulate Matter on Filter Media (A Fine Fraction of SRM 1649a Urban Dust on Quartz-Fiber Filters). The UHVS has been adapted to isolate the $\text{PM}_{2.5}$ portion from a subsample of SRM 1649a Urban Dust. This $\text{PM}_{2.5}$ portion of SRM

1649a has been homogenized and bottled for use in a future intercomparison study. The modified sampler can be used to isolate a PM_{2.5} fraction from a total suspended particulate sample to provide a bulk PM_{2.5} reference material.

Impact: The development of SRMs to support measurements for organic species in fine PM will expand the quality assurance capabilities to important source markers and species critical to human health.

Future plans: The high-volume sampler will be used in the development of PM_{2.5} reference material from a total suspended particulate sample.

Publications:

- Pancras, J. P., Ondov, J. M., Zeisler, R., “***Multielement Electrothermal AAS Determination of Eleven Marker Elements in Fine Ambient Aerosol Slurry Samples Collected with SEAS-II,***” *Analytica Chimica Acta* 2005, 538, 303-312.
- Schantz, M.M., Wise, S.A., and Lewtas, J., “***Intercomparison Program for Organic Speciation in PM_{2.5} Air Particulate Matter: Description and Results for Trials I and II,***” NISTIR 7229 (2005).